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PATENT APPLICATION

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Application No.: 09/471,192	)	
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Filed: December 23, 1999	)	
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For: IMAGE PROCESSING APPARATUS,	)	
IMAGE PROCESSING METHOD,	:	
AND STORAGE MEDIUM	)	September 21, 2004

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUBMISSION OF SWORN TRANSLATION

Sir:

Applicants hereby submit a sworn English translation of one of the Japanese priority applications, Japanese Patent Application No. 11-000683, a certified copy of which was submitted on March 27, 2000.

By submitting this translation, Applicants believe that they have antedated U.S. Patent 6,539,108 B1 (Kobayashi et al.), and removed that patent as prior art against those claims in the present application that are supported by the disclosure of the mentioned priority document.

Applicants' undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our address given below.

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DECLARATION

I, Yohei Kawabata, residing at 7th Fl., Shuwa Kioicho Park Bldg., 3-6, Kioicho, Chiyoda-ku, Tokyo 102-0094, Japan, hereby declare that I have a thorough knowledge of Japanese and English languages, and that the attached pages contain a correct translation into English of the application document of Japanese Patent Application No. 11-000683 filed on January 5, 1999 in the name of CANON KABUSHIKI KAISHA.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made, are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 2nd day of September, 2004.

Y. Kawabata

Yohei Kawabata

Translation of Japanese Patent Application No. 11-000683

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[Title of the Invention]

Image Processing Apparatus, Control Method, and Image Processing System

[Claims for the Patent]

[Claim 1]

An image processing apparatus comprising:

input means for inputting image data;

first and second rendering means for mapping and rendering the input image data;

conversion means for converting image data rendered in a first format by said first rendering means into a second format; and

selection means for selecting one of the image data in the second format converted by said conversion means, and the image data rendered in the second format by said first and second rendering means, on the basis of a format of the image data input by said input means.

[Claim 2]

The apparatus according to claim 1, wherein said selection means selects the image data in the second format converted by said conversion means when the image data input by said input means has the first format, and selects the image data rendered in the second format by said first and second rendering means

when the image data input by said input means has the second format.

[Claim 3]

The apparatus according to claim 2, further comprising print means for printing image data selected by said selection means on a recording medium.

[Claim 4]

The apparatus according to claim 3, wherein the second format can be processed by said print means.

[Claim 5]

The apparatus according to claim 4, wherein the second format is a YMCK format.

[Claim 6]

The apparatus according to claim 5, wherein the first format is an RGB format.

[Claim 7]

The apparatus according to claim 6, wherein said first rendering means performs one of rendering in units of R, G, and B color components and rendering in units of Y, M, and C color components in accordance with the format of the image data input by said input means.

[Claim 8]

The apparatus according to claim 7, wherein said second rendering means renders a K component.

[Claim 9]

The apparatus according to claim 3, wherein said first and second rendering means have, in units of colors:

a plurality of holding means for holding image data in units of predetermined bands;

rendering data generation means for rendering image data in units of bands in one of said holding means; and

rendering data output means for outputting image data in units of bands, which has already been rendered in the other of said holding means.

[Claim 10]

The apparatus according to claim 9, wherein said holding means hold bitmap data.

[Claim 11]

The apparatus according to claim 3, further comprising delay means for delaying the image data converted into the second format by said conversion means in units of colors in accordance with said print means, and

wherein said selection means selects the image data in the second format delayed by said delay means when the image data input by said input means has the first format.

[Claim 12]

The apparatus according to claim 3, further comprising delay means for delaying the image data

selected by said selection means in units of colors in accordance with said print means.

[Claim 13]

The apparatus according to claim 9, further comprising control means for predicting a rendering time of image data for one band by said first rendering means, and for, when the rendering time is shorter than a print time of image data for one band by said print means, controlling said print means to perform a print process.

[Claim 14]

The apparatus according to claim 13, wherein said input means inputs image data transferred from an external apparatus, and

said control means cancels a print process by said print means and informs the external apparatus that the print process is canceled, when the rendering time is not less than the print time.

[Claim 15]

The apparatus according to claim 14, wherein said control means informs the external apparatus that the print process is canceled, and urges the external apparatus to transfer image data in the second format.

[Claim 16]

The apparatus according to claim 13, wherein said control means controls said first rendering means to render image data in the first format when the

rendering time is shorter than the print time, and controls said first and second rendering means to render image data in the second format when the rendering time is not less than the print time.

[Claim 17]

The apparatus according to claim 16, wherein said control means controls based on resolution of image data whether image data is rendered in the first or second format.

[Claim 18]

The apparatus according to claim 16, wherein said control means controls based on the number of gray levels of image data whether image data is rendered in the first or second format.

[Claim 19]

The apparatus according to claim 16, wherein said control means controls based on a delay amount of image data whether image data is rendered in the first or second format.

[Claim 20]

An image processing system in which a host device is connected to an image processing apparatus, wherein the image processing apparatus comprises:

input means for inputting image data transferred from said host device;

first and second rendering means for developing and rendering input image data;

conversion means for converting image data rendered in a first format by said first rendering means into image data in a second format; and

selection means for selecting one of image data in a second format converted by said conversion means and image data rendered in a second format converted by said first and second rendering means based on a format of image data input by said input means; and

printing means for printing the selected image data on a record medium.

[Claim 21]

A control method for use with an image processing apparatus for printing input image data, comprising:

a first rendering step of rendering image data and rendering the data in a first format when the input image data is in a first format;

a converting step of converting image data rendered in a first format in the first rendering step into data in a second format;

a first output step of printing image data converted by said converting step;

a second rendering step of developing and rendering the image data in a second format when the input image data is in a second format;

a second output step for printing image data rendered in the second rendering step.

[Claim 22]

A record medium recording a control program in a image processing system for printing input image data, the control program comprising:

a code of a first rendering step of developing and rendering the image data in a first format when the input image data is in a first format;

a code of a converting step of converting image data rendered in a first format in said first rendering step into data in a second format;

a code of a first output step of printing image data converted in said converting step;

a code of a second rendering step of developing and rendering image data in a second format when the input image data is in a second format; and

a code of a second output step of printing image data rendered in said second rendering step.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to an image processing apparatus, its control method, and an image processing system.

[0002]

[Prior Art]

Conventionally, most of image processing apparatuses that print multi-color images form an image on a recording medium using a plurality of colors of

recording agents such as yellow (Y), magenta (M), cyan (C), black (K), and the like.

[0003]

In a system in which such image processing apparatus and a host computer are connected, image data is normally generated on the host computer side. Hence, it is often the case that image data consisting of red (R), green (G), and blue (B) color components that can be displayed on a CRT or the like is generated, and image data in the RGB format (to be referred to as RGB data hereinafter) is transferred to the image processing apparatus side.

[0004]

The image processing apparatus prints an image by the following method on the basis of the transferred RGB data.

[0005]

For example, after RGB data for one page is rendered, the rendered data is batch-converted into a YMCK format. Image data in the YMCK format (to be referred to as YMCK data hereinafter) for one page undergoes processes such as compression and the like as needed, and is then stored in a memory or the like. In response to a print start command, the YMCK data is transferred to an engine unit to print an image on a recording medium.

[0006]

Alternatively, RGB data transferred from the host computer is converted into YMCK data, and print data for one page is generated in units of Y, M, C, and K colors, thus printing an image.

[0007]

In a conventional image processing apparatus, a method (banding) for dividing print contents for one page into a plurality of bands, and parallelly executing actual print operation on a recording medium and a print data generation process in units of bands so as to reduce the image memory size required in the print process is known.

[0008]

[Problem to be Solved by the Invention]

However, the conventional image processing apparatus assumes that the format of input image data is either the RGB or YMCK format. Hence, an image processing apparatus which is set to receive data in the RGB format cannot directly receive image data in the YMCK format although it finally prints data in the YMCK format.

[0009]

The present invention has been developed to solve the above-mentioned problems, and aims at providing an image processing apparatus capable of forming and printing an appropriate image, a method for use with the apparatus, and an image processing system regardless of an input image data format.

[0010]

Another object of the present invention is to provide an image processing apparatus capable of performing high-quality printing without increasing the memory requirement in the apparatus, a method for the apparatus, and an image processing system.

[0011]

[Means for Solving the Problems]

As means for attaining the above-mentioned purposes, the image processing apparatus according to the present invention has the following configuration.

[0012]

That is, the image processing apparatus comprising: input means for inputting image data; first and second rendering means for mapping and rendering the input image data; conversion means for converting image data rendered in a first format by said first rendering means into a second format; and selection means for selecting one of the image data in the second format converted by said conversion means, and the image data rendered in the second format by said first and second rendering means, on the basis of a format of the image data input by said input means.

[0013]

For example, the selection means selects the image data in the second format converted by the conversion means when the image data input by the input means has

the first format, and selects the image data rendered in the second format by the first and second rendering means when the image data input by the input means has the second format.

[0014]

Furthermore, the apparatus includes printing means for printing the image data selected by the selection means on a record medium.

[0015]

For example, the second format is a YMCK format, and the first format is an RGB format.

[0016]

[Embodiments of the Invention]

Preferred embodiments according to the present invention will be described in detail hereinafter with reference to the accompanying drawings.

[0017]

<First Embodiment>

• Overall Arrangement

Fig. 1 is a block diagram showing the arrangement of an image processing apparatus of this embodiment. Referring to Fig. 1, reference numeral 26 denotes a controller; and 28, an engine. The controller 26 is connected to a host computer 1 as an external apparatus.

[0018]

In the controller 26, reference numeral 2 denotes a CPU for systematically controlling the entire image processing apparatus; 3, a ROM for holding programs and

the like executed by the CPU 2; 4, a RAM which serves as a work area of the CPU 2, and holds a display list (to be described later); 5, a DMA controller for reading out the display list from the RAM 4, and transferring it to renderers via a bus 27; and 6, an interface for controlling data transfer with the host computer 1.

[0019]

Reference numerals 7, 8, 9, and 10 denote renderers for respectively rendering R and Y, G and M, B and C, and K data on the basis of the display list (to be respectively referred to as an R renderer 7, G renderer 8, B renderer 9, and K renderer 10 hereinafter). Reference numeral 11 denotes a color space converter for converting RGB data for one band, output from the R, G, and B renderers 7, 8, and 9, into data in a YMCK color space in correspondence with a print data format in the engine 28. Reference numerals 12, 13, and 14 denote delay circuits for delaying YMCK data converted by the color space converter 11 in correspondence with print timings. The delay circuits 12, 13, and 14 respectively receive M, C, and K data and delay them by times T, 2T, and 3T. That is, Y, M, C, and K data are respectively delayed to have a time difference T. Reference numeral 15 to 18 denote selectors which select the outputs from the delay circuits 12 to 14 and renderers 7 to 10 under the

control of the CPU 2, and output selected outputs to the engine 28.

[0020]

In the engine 28, reference numerals 19 to 22 denote developers for developing corresponding color image data using recording agents; 23, a transfer belt for superposing images developed in units of colors to complete a multi-color image for one page; and 24, a transfer roller for transferring the multi-color image formed on the transfer belt 23 onto a recording medium 25.

[0021]

• Renderer Arrangement

Fig. 2 is a block diagram showing the detailed arrangement of the R renderer. Note that since the renderers 7 to 10 have the same arrangement, only the R renderer 7 will be explained below.

[0022]

Referring to Fig. 2, reference numeral 100 denotes a FIFO; 101, a shape generator for generating shape data that indicates the outer shape of an image; and 102, a color register. By computing the AND of shape data generated by the shape generator 101 and a color designated by the color register 102, new image data to be written (to be referred to as write data hereinafter) is generated. Reference numeral 103 denotes a register for holding a rendering logic of bitmap data held in advance in the apparatus, and write

data; and 104, a coefficient register for holding a mixing ratio of the bitmap data and write data. Note that the storage location of the bitmap data is not particularly limited, and the bitmap data may be stored in, e.g., the RAM 4.

[0023]

The contents of these registers are set based on the display list input from the host computer or made by CPU 2 in accordance with host computer commands.

[0024]

Reference numeral 105 denotes a BPU (bit processing unit) for making a logic operation of the bitmap data and write data in practice. Write data is generated by ANDing shape data generated by the shape generator 101 and a color designated by the color register, and then undergoes a logic operation with bitmap data in accordance with parameters held in the rendering logic register 103 and coefficient register 104. The operation result is held in the BPU 105 as new bitmap data.

[0025]

Reference numerals 106 and 109 denote selectors which control to alternately use one of two band memories 107 and 108, which hold bitmap data in units of bands, as a rendering data generation buffer, and the other as an output buffer for outputting already complete bitmap data for one band.

[0026]

Reference numeral 110 denotes a video shipper for controlling generation of addresses, bus width conversion, and the like of the band memories 107 and 108 as output buffers so as to output bitmap data in accordance with the rendering timings of respective color images.

[0027]

• Details of Display List

Image data in this embodiment is generated by the host computer 1, and is input to the host interface 6 in a predetermined format. The image data in the predetermined format is interpreted and mapped into a display list by the CPU 2, and the display list is stored in the RAM 4. The display list in this embodiment will be described in detail below.

[0028]

Fig. 3 shows an example of the data format of the display list, and Figs. 4A to 4D show an example of the contents of the display list corresponding to actual image data.

[0029]

One element of the display list is generated for each character unit in image data. In the example of the format of the display list shown in Fig. 3, reference numeral 200 denotes a rendering coordinate position indicating a rendering position of an image unit (character or the like) to be rendered to have a start point of each band as an origin; 201, a number

indicating the outer shape of an image to be rendered; and 202, a rendering logic which indicates logic operations to be applied to bitmap data and image data to be rendered. As the rendering logic 202, "OR" indicating logic sum operation, "EXOR" indicating reversal of an image, and the like are set in accordance with a rendering instruction from the host computer 1. Reference numeral 203 denotes color data indicating color information to be assigned to rendering shape data. As the color data 203, color information is designated in the RGB or YMCK format.

[0030]

Reference numerals 204 and 205 respectively denote rendering height information and write start line information, which set the write start line and the number of lines to be rendered of the outer shape designated by the rendering outer shape 201. For example, when a character which extends over two bands is to be rendered, in the upper band, the write start line 205 indicates the start line of the outer shape of that character and the rendering height 204 indicates a height from that start line to the end line of the upper band. On the other hand, in the lower band, the write start line 205 indicates the start line of that band, and the rendering height 204 indicates the height from that start line to the end line of the image outer shape.

[0031]

Reference numeral 206 denotes transparency, i.e., a mixing ratio, required upon mixing bitmap and image data based on the logic operations designated by the rendering logic 202.

[0032]

Examples of the individual elements of the above-mentioned display list will be explained below using FIG. 4.

[0033]

A display list for a character image shown in (a) in FIG. 4 will be taken as an example. A character image shown in (a) in FIG. 4 consists of two bands 207 and 208. Elements of the display list are generated in units of characters indicated by element numbers #1 to #5 in, e.g., the band 207, and (b) in FIG. 4 shows that example.

[0034]

For example, assume that characters indicated by element numbers #1 and #2 in (a) in FIG. 4 have coordinate positions in the band 207, as shown in (c) in FIG. 4. In this case, "(X1, Y1)" is set for the rendering coordinate 200 as one element of element number #1, as shown in (b) in FIG. 4. As for the rendering outer shape 201, "F1" indicating character "C" is set on the basis of an outer shape list shown in, e.g., (d) in FIG. 4. As for element numbers #3 and #5, since corresponding characters have an identical outer shape "n", "F3" is set based on (d) in FIG. 4.

[0035]

As for the rendering logic 202, "OR" of write data (Dist) and bitmap data (Obj) is set. Also, the color data 203 is set in units of color components of the RGB format. In Fig. 4B, the setting contents of the rendering height 204 and write start line 205 are omitted, and finally, the transparency is set at 100%.

[0036]

Note that the individual items that form the display list shown in Fig. 3 are held in the corresponding registers in each renderer as follows. That is, the rendering coordinate 200, rendering outer shape 201, rendering height 204, and write start line 205 are held in the shape generator 101, the color data 203 in the color register 102, the rendering logic 202 in the rendering logic register 103, and the transparency 206 in the coefficient register 104.

[0037]

Note that print data for one page is divided in units of bands, and is converted into a display list.

[0038]

• Banding Determination Process

In this embodiment, a banding process is done under the control of the CPU 2 so as to reduce the image memory size required in the print process. More specifically, print contents for one page are divided into a plurality of bands, the print process onto the

banding recording medium and the rendering process of print data are parallelly executed in units of bands.

[0039]

As described above, upon completion of a display list for one page, the CPU 2 determines if a print process can be done in units of bands, and prints based on the determination result. Fig. 5 is a flow chart showing the details of this determination process.

[0040]

First, in step S300, the contents of the display list are developed to generate rendering data, and obtains band rendering times by computing the units of bands from the time required for the rendering data. In this case, a margin level (coefficient) of each band rendering time with respect to a band print time, which is set in advance in the ROM 3 or the like, is loaded.

[0041]

In step S301, the sum of the band rendering times is multiplied by the coefficient to compute an expected rendering time per band (expected band rendering time).

[0042]

It is then checked in step S302 if the computed expected band rendering time falls within a time required for printing one band (to be referred to as a band print time hereinafter). That is, if the expected band rendering time falls within the band print time, it is determined that a print process by means of

banding is possible, and a banding print process in step S303 is executed. On the other hand, if the expected band rendering time is longer than the band print time, it is determined that a print process of one band parallel to a rendering process of the next band, i.e., the print process by means of banding cannot be done. The flow then advances to step S304 to execute a non-banding print process. For example, the print process is canceled, and a message indicating that the banding print process is impossible is sent to the host computer 1, or such message is displayed for the operator using a console (not shown) of the image processing apparatus. A process for normally printing an image such as a change of print contents themselves (e.g., if print data is multi-valued image data, it is converted into data having a smaller number of gray levels), or the like may be made.

[0043]

In the present embodiment, even when a banding print process in the RGB format is impossible, a banding print process in the YMCK format may be possible in some cases, as will be described later. Hence, upon sending a message indicating that the banding print process is impossible to the host computer 1 in step S304, it is effective to inform the operator that it may be possible to print by transferring image data in the YMCK format.

[0044]

That is, if it is determined in step S302 that the banding print process in the RGB format is possible, a banding print process in the RGB format is executed in step S303; if it is determined that the banding print process in the RGB format is impossible, a banding print process in the YMCK format can be executed in step S304.

[0045]

• Banding Print process

The banding print process in step S303 will be explained in detail below.

[0046]

If the CPU 2 determines that the banding print process is possible, the DMA controller 5 reads out the required display list from the RAM 4 and writes the display list in the R, G, and B renderers 7, 8, and 9 via the bus 27.

[0047]

For example, in the R renderer 7, the input display list is temporarily stored in the FIFO 100, and respective parameters included in that display list are set in the shape generator 101, color register 102, rendering logic register 103, and coefficient register 104. After the parameters are set, the BPU 105 selects one of the band memories 107 and 108, which is used to generate rendering data, and loads bitmap data at the rendering position, which is to undergo an arithmetic

operation with write data, via the selector 106. Assume that the band memory 107 is selected.

[0048]

The BPU 105 generates rendering data by making an arithmetic operation of bitmap data at the rendering position loaded from the selected band memory 107 with write data using the parameters designated by the shape generator 101, color register 102, rendering logic register 103, and coefficient register 104, and writes it at the rendering position of the band memory 107.

[0049]

For example, when the transparency 206 is "0.4", color data 203 is "R = 0E0(h)", and rendering logic 202 is "overwrite" in one element of a display list that indicates given write data, and when bitmap data at the corresponding rendering position is "R = 010(h)", the BPU 105 makes an arithmetic operation given by:

[0050]

$$0E0h \times 0.4 + 010h \times (1 - 0.4)$$

In this case, "63" is written at the rendering position of the band memory.

[0051]

At this time, since the band memory which is not used to generate rendering data (the band memory 108 in this case) stores rendering data which is already complete in the previous band, the video shipper 110 sequentially reads out the rendering data from the head of the band memory 108 via the selector 109 and outputs

it as rendering data to be printed from the R renderer 7.

[0052]

When rendering data output from the rendering data have the RGB format, the RGB rendering data are converted into data in a color space used in the print process in the engine 28, i.e., into four planes, i.e., Y, M, C, and K planes by, e.g., masking processes of the color space converter 11. Note that the individual planes are simultaneously converted.

[0053]

When the engine 28 forms Y, M, C, and K plane images on a recording medium, predetermined time differences are produced in units of planes due to the physical arrangements of the individual image forming units. Hence, the image forming timings in units of planes are adjusted by delaying three out of four colors via the delay circuits 12 to 14. For example, when the developers 19 to 22 for the respective colors are placed at equal intervals, and time T is required for conveying the recording medium between neighboring developers, a delay circuit for delaying time T between the first and second image planes, a delay circuit for delaying 2T (T × 2) until the third image plane, and a delay circuit for delaying 3T until the last image plane are required. Hence, the delay circuits 12 to 14 respectively delay T, 2T, and 3T, and comprise means

(buffers) for holding image data rendered during time periods T, 2T, and 3T.

[0054]

• Control Based on Input Data Format

This embodiment is characterized by making the following control based on the input image data format.

[0055]

When image data in the RGB format is transferred from the host computer 1, the renderers 7 to 9 respectively render R, G, and B images, the rendered R, G, and B image data are converted into the YMCK format by the color space converter 11, and the banding print process is then made. In this case, the K renderer 10 is not used. Note that the renderers 7 to 9 load the display list at the same timings, and required data are stored in their registers.

[0056]

On the other hand, when image data in the YMCK format is transferred from the host computer 1, the renderers 7 to 9 respectively render Y, M, and C images, and the renderer 10 renders a K image. The YMCK outputs from the renderers 7 to 10 are directly input to the selectors 15 to 18 since they need not undergo any conversion in the color space converter 11. Hence, since the outputs from the renderers are not delayed, the timings at which the display list is loaded to generate images in the respective renderers must be shifted by T.

[0057]

As described above, the delay circuits 12 to 14 comprise buffers for holding image data rendered during time periods T, 2T, and 3T. Hence, when a high-quality print process (e.g., an increase in number of gray levels, resolution, or the like) is to be made, the delay circuits 12 to 14 must have a larger buffer size, resulting in high cost.

[0058]

According to this embodiment, when a print process is made at the normal number of gray levels or resolution, RGB rendering is made; when a high-quality print process is to be made, YMCK rendering is made to obviate the need for increasing the buffer size of the delay circuits 12 to 14. That is, the delay circuits 12 to 14 need only have a buffer size large enough to make a print process at the normal number of gray levels or resolution. When a high-quality print process is made, YMCK rendering is done. In this case, since no color space conversion is required, optimal cost performance can be obtained in the image processing apparatus.

[0059]

Similarly, even when the print process is impossible due to too small a buffer size of the delay circuits in the RGB format, it may be possible in the YMCK format.

[0060]

Note that the format of image data to be transferred can be controlled by the host computer 1. When a high-quality print process is to be made or when it is informed that a banding print process is impossible in the RGB format, image data can be transferred to the image processing apparatus in the YMCK format.

[0061]

As described above, according to the image processing apparatus of this embodiment, even when image data input from the host computer has either the RGB or YMCK format, rendering data can be appropriately generated and printed out.

[0062]

Even when a banding print process in the RGB format is impossible, a banding print process in the YMCK format is possible, and a high-quality image can be printed using a smaller memory size.

[0063]

Since image data in the YMCK format is input and printed out, a high-quality print process is achieved without increasing the memory size in the apparatus.

[0064]

<Second Embodiment>

The second embodiment according to the present invention will be described in detail below.

[0065]

Fig. 6 is a block diagram showing the arrangement of the image processing apparatus according to the second embodiment. The same reference numerals in the second embodiment denote the same parts as in the arrangement shown in Fig. 1 of the first embodiment, and a detailed description thereof will be omitted. The arrangement shown in Fig. 6 is characterized in that the delay circuits 12 to 14 shown in Fig. 1 are inserted after the selectors 16 to 18.

[0066]

Hence, in the second embodiment, even when image data in the YMCK format is input, the renderers need not shift the timings at which the display list is read to generate images by T. That is, Y, M, C, and K planes can be simultaneously rendered as in RGB rendering in the first embodiment. Therefore, in each of renderers 7 to 10, the shape data can be simultaneously read. As a result, the load in the bus 27 can be reduced.

[0067]

Fig. 7 shows the load states of the bus 27. Fig. 7(a) shows a case wherein different bands are rendered by shifting rendering timings in units of Y, M, C, and K planes, and Fig. 7(b) shows a case wherein identical bands are rendered in the individual planes. According to Fig. 7(b), when the renderers 7 to 10 simultaneously load shape data (MASK), the load on the bus 27 can be reduced compared to a case wherein

different bands are rendered shown in (a) in Fig. 7, thus improving rendering performance.

[0068]

As described above, according to the second embodiment, in addition to the effect obtained in the first embodiment, even when image data in the YMCK format is input, each renderer need not perform any delay control. Therefore, since Y, M, C, and K planes can be rendered at the same time, the load on the bus 27 can be reduced.

[0069]

[Other Embodiments]

Note that the present invention may be applied to either a system constituted by a plurality of devices (e.g., a host computer, an interface device, a reader, a printer, and the like), or an apparatus consisting of a single equipment (e.g., a copying machine, a facsimile apparatus, or the like).

[0070]

The objects of the present invention are also achieved by supplying a storage medium, which records a program code of a software program that can implement the functions of the above-mentioned embodiments to the system or apparatus, and reading out and executing the program code stored in the storage medium by a computer (or a CPU or MPU) of the system or apparatus.

[0071]

In this case, the program code itself read out from the storage medium implements the functions of the above-mentioned embodiments, and the storage medium which stores the program code constitutes the present invention.

[0072]

As the storage medium for supplying the program code, for example, a floppy disk, hard disk, optical disk, magneto-optical disk, CD-ROM, CD-R, magnetic tape, nonvolatile memory card, ROM, and the like may be used.

[0073]

The functions of the above-mentioned embodiments may be implemented not only by executing the readout program code by the computer but also by some or all of actual processing operations executed by an OS (operating system) running on the computer on the basis of an instruction of the program code.

[0074]

Furthermore, the functions of the above-mentioned embodiments may be implemented by some or all of actual processing operations executed by a CPU or the like arranged in a function extension board or a function extension unit, which is inserted in or connected to the computer, after the program code read out from the storage medium is written in a memory of the extension board or unit.

[0075]

[Advantage of the Invention]

According to the above-mentioned invention of the present case, appropriate image formation and print processes can be achieved irrespective of the format of input image data.

[0076]

Also, a high-quality print process can be achieved without increasing the memory size in the apparatus.

[0077]

[Brief Description of the Drawings]

[FIG. 1]

Fig. 1 is a block diagram showing the arrangement of an image processing apparatus according to the first embodiment of the present invention.

[FIG. 2]

Fig. 2 is a block diagram showing the detailed arrangement of a renderer.

[FIG. 3]

Fig. 3 shows the format of a display list.

[FIG. 4]

FIG. 4 is a view for explaining the contents of the display list.

[FIG. 5]

FIG. 5 is a flow chart showing a banding determination process.

[FIG. 6]

FIG. 6 shows graphs of the bus load and rendering time in RGB banding and YMCK banding.

[FIG. 7]

is a block diagram showing the arrangement of an image processing apparatus according to the second embodiment of the present invention.

[Description of Symbols]

1 Host computer

2 CPU

3 ROM

4 RAM

5 DMAC

6 HOST I/F

7 Y/R renderer

8 M/G renderer

9 C/B renderer

10 K renderer

11 Color space converter

12, 13, 14 Delay circuit

15 to 18 Selector

19 to 22 Developers

23 Transfer belt

24 Transfer roller

25 Record medium

26 Controller

27 Selector

28 Engine

100 FIFO

101 Shape generator

102 Color register

103 Rendering logic register

104 Coefficient register

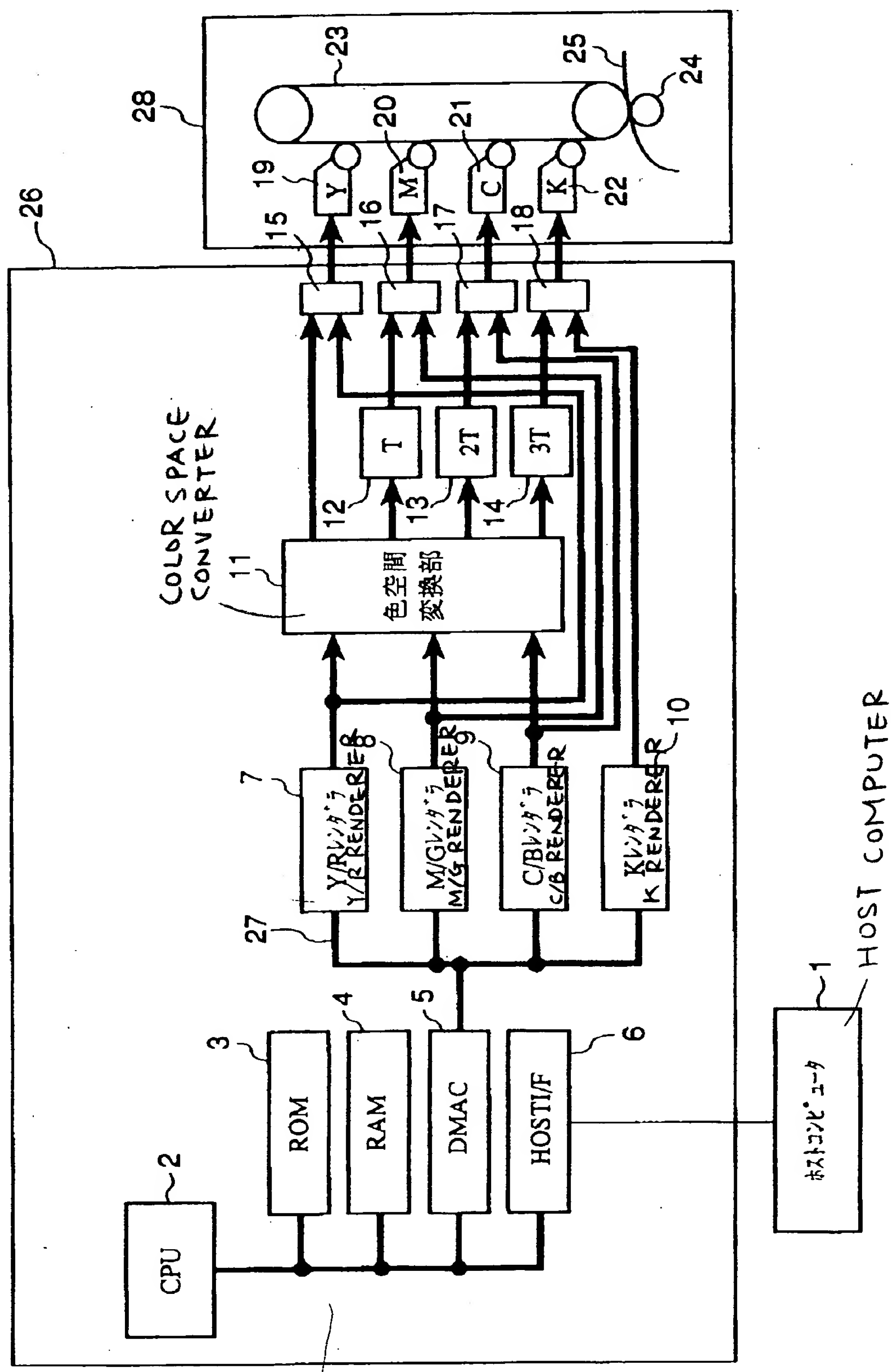
105 BPU

106, 109 Selector

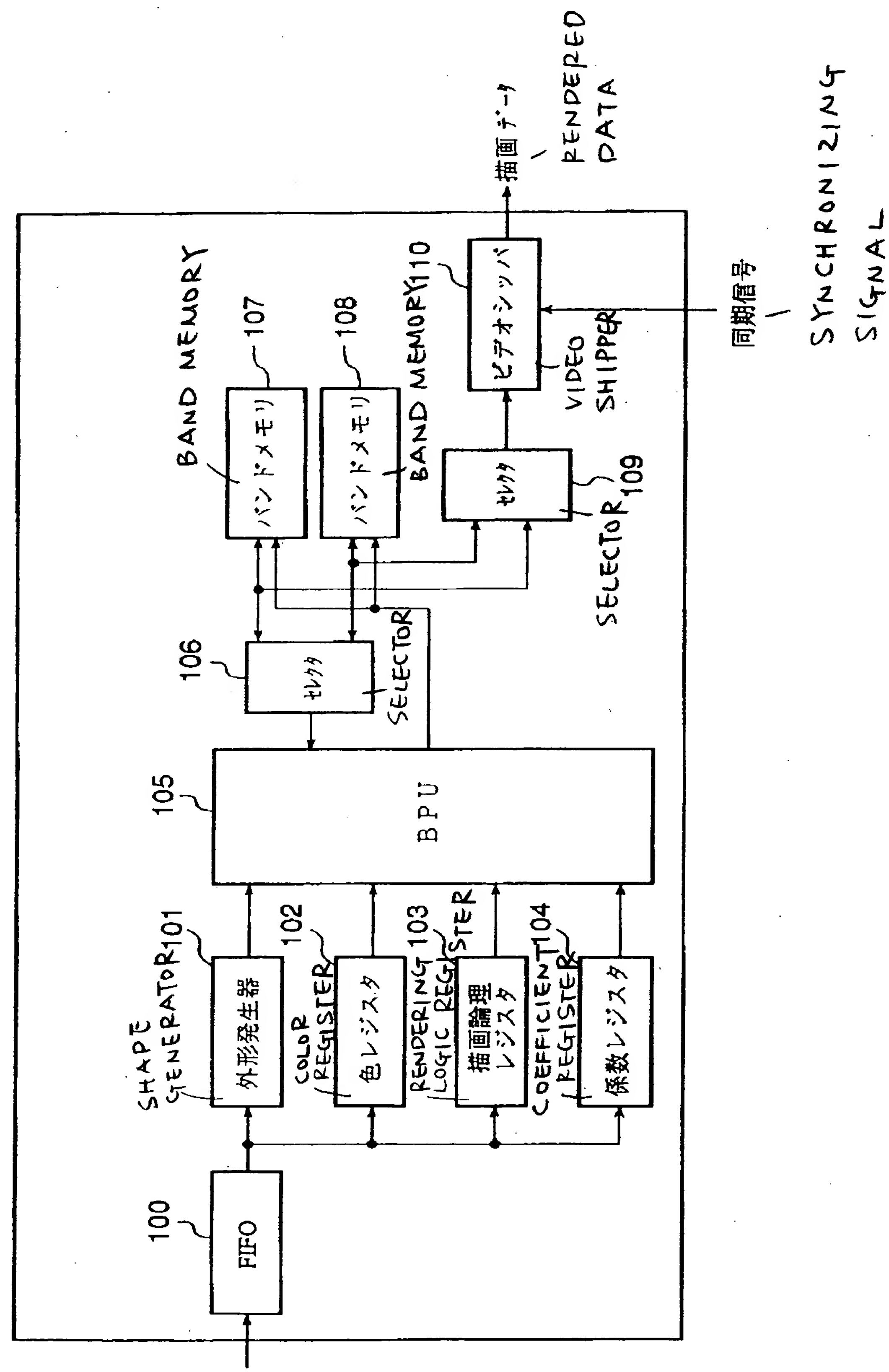
107, 108 Band memory

110 Video shipper

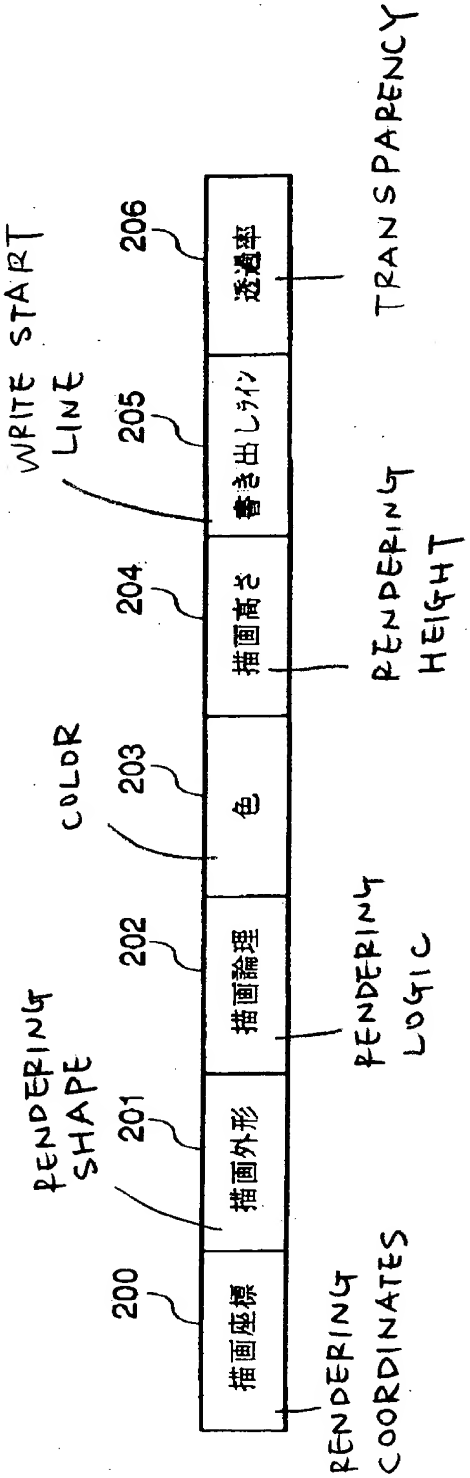
{TYPE OF DOCUMENT}【図１】　FIG. 1



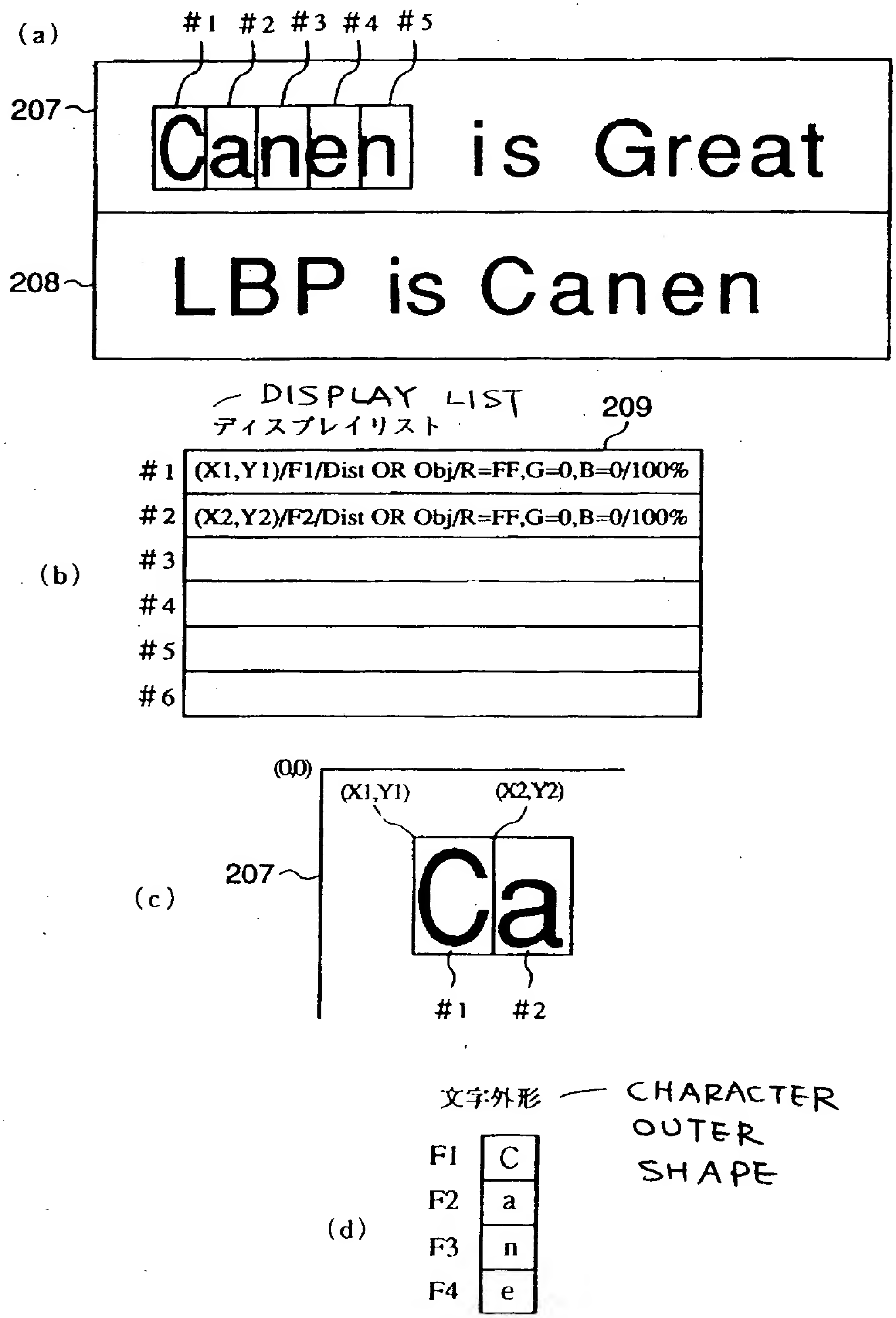
【図２】　FIG. 2


FIFO
100
外形発生器
SHAPE GENERATOR
101
色レジスタ
COLOR REGISTER
102
描画論理レジスタ
RENDERING LOGIC REGISTER
103
係数レジスタ
COEFFICIENT REGISTER
104
BPU
105
セレクタ
SELECTOR
106
バンドメモリ
BAND MEMORY
107
バンドメモリ
BAND MEMORY
108
セレクタ
SELECTOR
109
ビデオシッパ
VIDEO SHIPPER
110
描画データ
RENDERED DATA
同期信号
SYNCHRONIZING SIGNAL

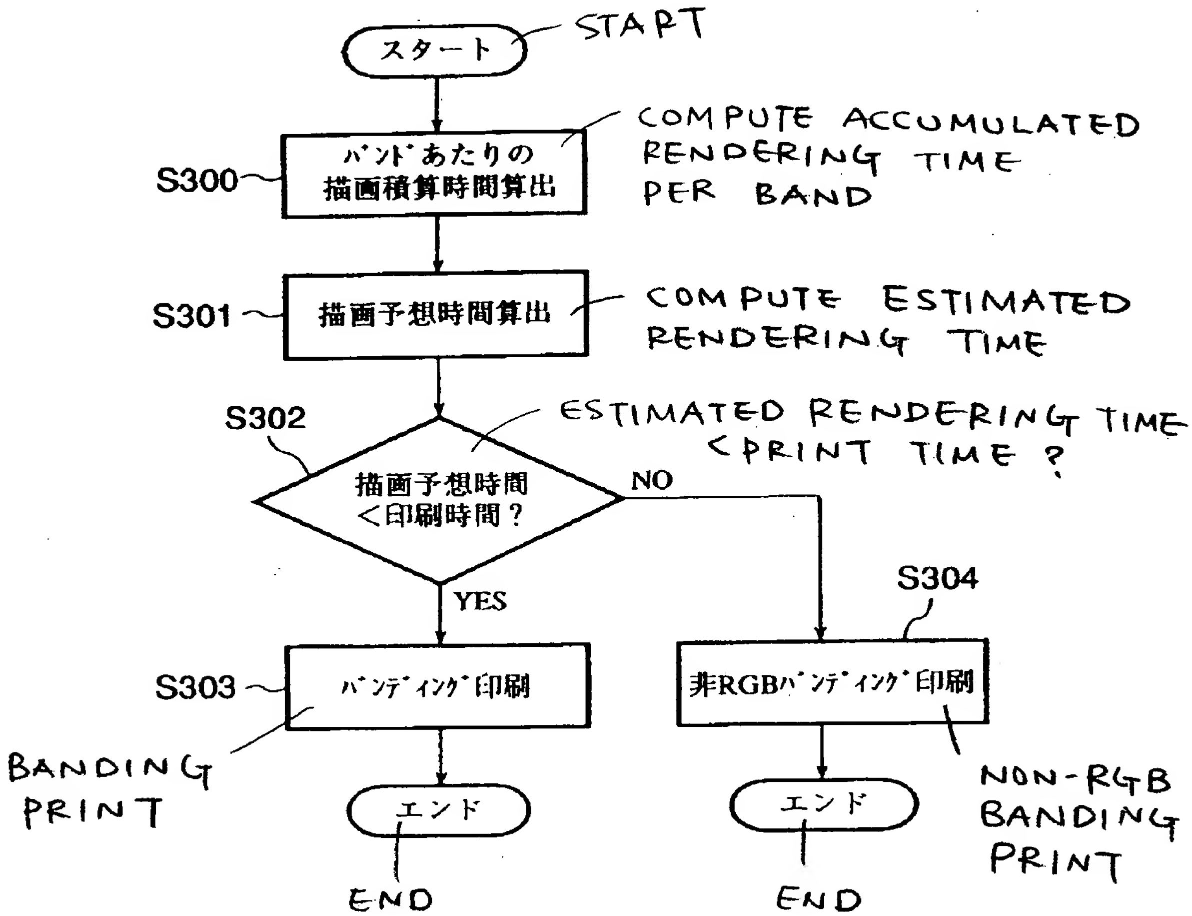
【図3】 FIG. 3


描画座標
200
RENDERING COORDINATES
描画外形
201
RENDERING SHAPE
描画論理
202
RENDERING LOGIC
色
203
COLOR
描画高さ
204
RENDERING HEIGHT
書き出しライン
205
WRITE START LINE
透過率
206
TRANSPARENCY

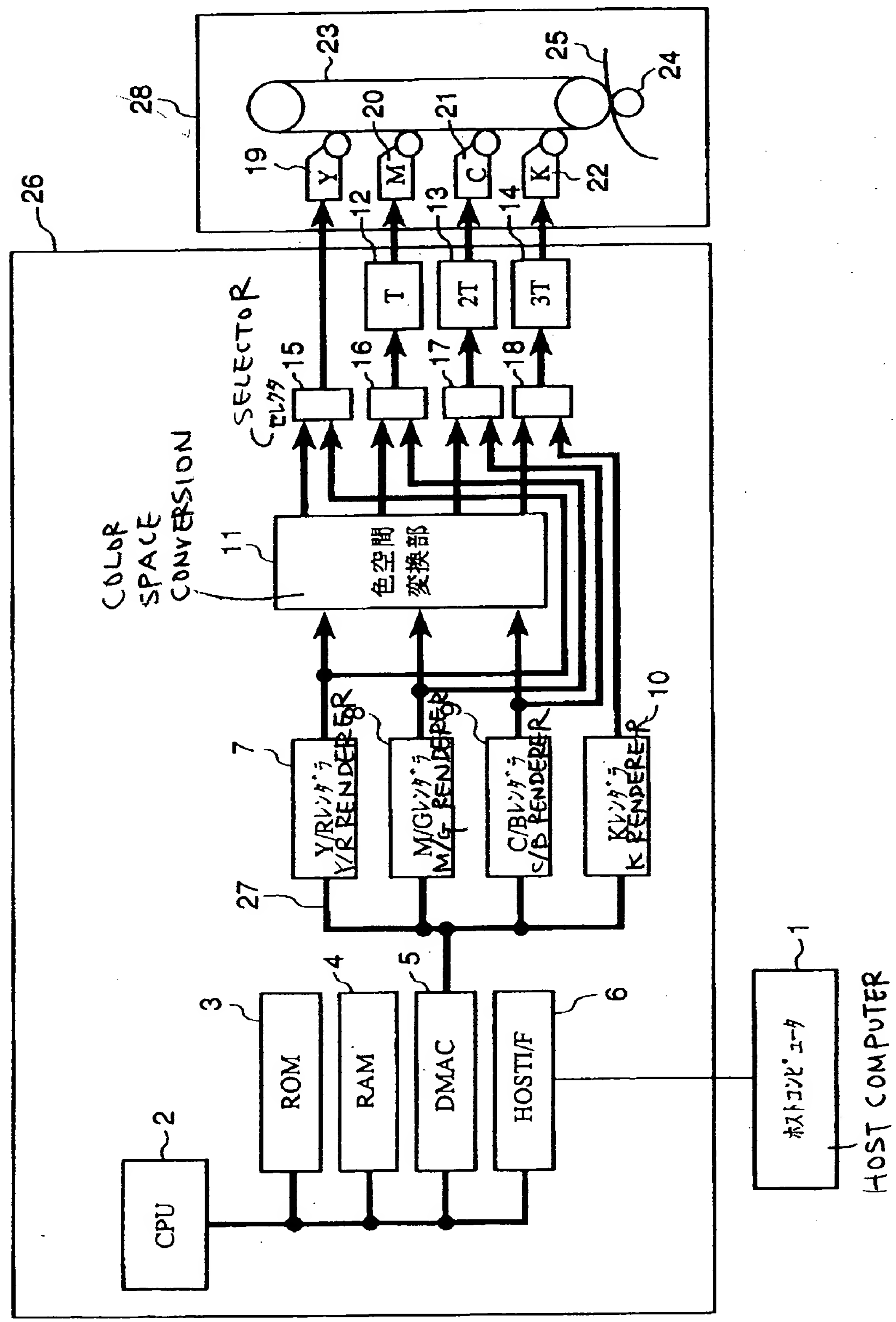
【図４】 FIG. 4


(a)
#1 #2 #3 #4 #5
207
Canen is Great
208
LBP is Canen
DISPLAY LIST
ディスプレイリスト
209
(b)
#1 (X1,Y1)/F1/Dist OR Obj/R=FF,G=0,B=0/100%
#2 (X2,Y2)/F2/Dist OR Obj/R=FF,G=0,B=0/100%
#3
#4
#5
#6
(c)
(0,0)
(X1,Y1)
(X2,Y2)
207
Ca
#1 #2
(d)
文字外形
CHARACTER OUTER SHAPE
F1 C
F2 a
F3 n
F4 e

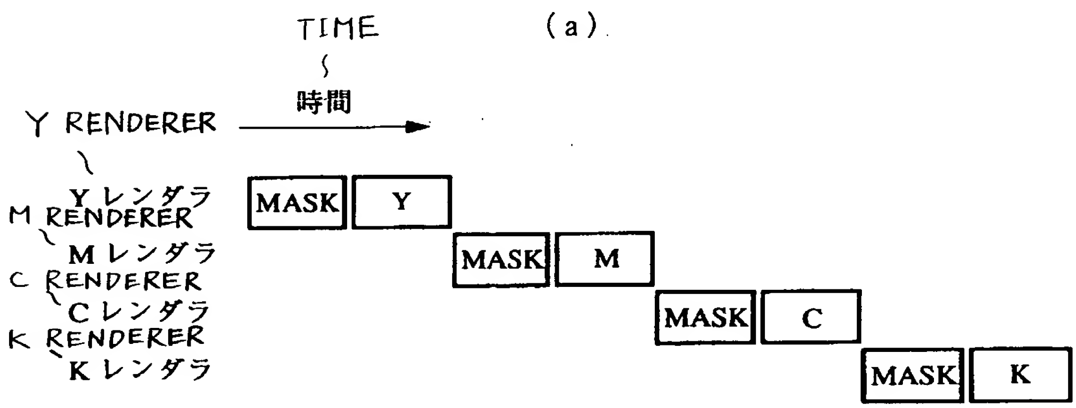
【図５】 FIG. 5

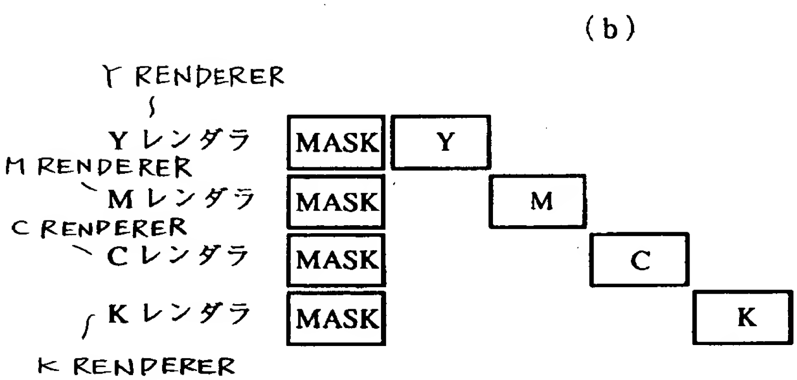


【図６】 FIG. 6


CPU
ROM
RAM
DMAC
HOSTI/F
ホストコンピュータ
HOST COMPUTER
Y/Rレンダラ
Y/R RENDERER
M/Gレンダラ
M/G RENDERER
C/Bレンダラ
C/B RENDERER
Kレンダラ
K RENDERER
色空間変換部
COLOR SPACE CONVERSION
セレクタ
SELECTOR
T
2T
3T
Y
M
C
K

【図7】 Fig. 7


(a)
TIME
時間
Y RENDERER
Y レンダラ
M RENDERER
M レンダラ
C RENDERER
C レンダラ
K RENDERER
K レンダラ
MASK
Y
MASK
M
MASK
C
MASK
K


(b)
Y RENDERER
Y レンダラ
M RENDERER
M レンダラ
C RENDERER
C レンダラ
K レンダラ
K RENDERER
MASK
Y
MASK
M
MASK
C
MASK
K

[Title of the Document] Abstract

[Abstract]

[Object]

An image processing apparatus which is set to receive data in the RGB format cannot directly receive image data in the YMCK format although a print process is finally done in the YMCK format.

[Solving Means]

When RGB data is input from a host computer, renderers respectively render the R, G, and B data, the rendered R, G, and B data are converted into YMCK data by a color space converter, and the YMCK data is output to an engine. On the other hand, when YMCK data is input, renderers respectively render Y, M, C, and K image data, and directly output them to the engine.

[Selected Drawing] FIG. 1